US008876310B2

(12) **United States Patent**
Nozaki et al.

(10) **Patent No.: US 8,876,310 B2**
(45) **Date of Patent: Nov. 4, 2014**

(54) **OPERATION DEVICE**

(75) Inventors: **Makoto Nozaki**, Yokkaichi (JP); **Hirokatsu Nakajima**, Yokkaichi (JP)

(73) Assignee: **Sumitomo Wiring Systems, Ltd.**, Mie (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 317 days.

(21) Appl. No.: **13/580,229**

(22) PCT Filed: **Feb. 10, 2011**

(86) PCT No.: **PCT/JP2011/000750**
§ 371 (c)(1),
(2), (4) Date: **Aug. 21, 2012**

(87) PCT Pub. No.: **WO2011/108196**
PCT Pub. Date: **Sep. 9, 2011**

(65) **Prior Publication Data**

US 2012/0314397 A1 Dec. 13, 2012

(30) **Foreign Application Priority Data**

Mar. 1, 2010 (JP) 2010-044084

(51) **Int. Cl.**
G01D 11/28 (2006.01)
H01H 19/02 (2006.01)

(52) **U.S. Cl.**
CPC ***H01H 19/025*** (2013.01); *H01H 2219/06* (2013.01); *H01H 2219/0622* (2013.01); *H01H 2221/008* (2013.01)
USPC **362/23.22**

(58) **Field of Classification Search**
CPC H01H 19/025; G04B 19/30
USPC 362/23.14, 23.01, 23.22; 200/310, 316, 200/317
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,044,214	A *	8/1977	Rayburn et al.	200/316
4,853,151	A *	8/1989	Vogtle et al.	252/299.61
6,224,221	B1 *	5/2001	Glienicke	362/23
6,948,824	B2 *	9/2005	Miwa	362/26
8,425,100	B2 *	4/2013	Akabori et al.	362/551
2006/0227528	A1 *	10/2006	Nakamoto et al.	362/23

FOREIGN PATENT DOCUMENTS

DE	102005057025	1/2007
JP	11-134932	5/1999
JP	2002-231101	8/2002
JP	3744799	2/2006
JP	2008-016332	1/2008

* cited by examiner

Primary Examiner — Julie Bannan
(74) *Attorney, Agent, or Firm* — Greenblum & Bernstein, P.L.C.

(57) **ABSTRACT**

An operation device is capable of illuminating a peripheral wall of an operation knob in a circumferential direction. The operation device includes an operation knob having a substantially cylindrical peripheral wall centering on an axis and rotating around the axis, the peripheral wall being provided with an illuminated portion in a circumferential direction; an illumination light source provided on the axis of the operation knob and emitting light frontward; and a reflector. A reflection surface is configured with a portion of a surface of the reflector provided inside the operation knob. The reflection surface has a shape extending in the circumferential direction centering on the axis of the operation knob and having a diameter increasing toward a front side such that the light emitted frontward from the illumination light source is reflected by the reflection surface toward the illuminated portion.

5 Claims, 3 Drawing Sheets

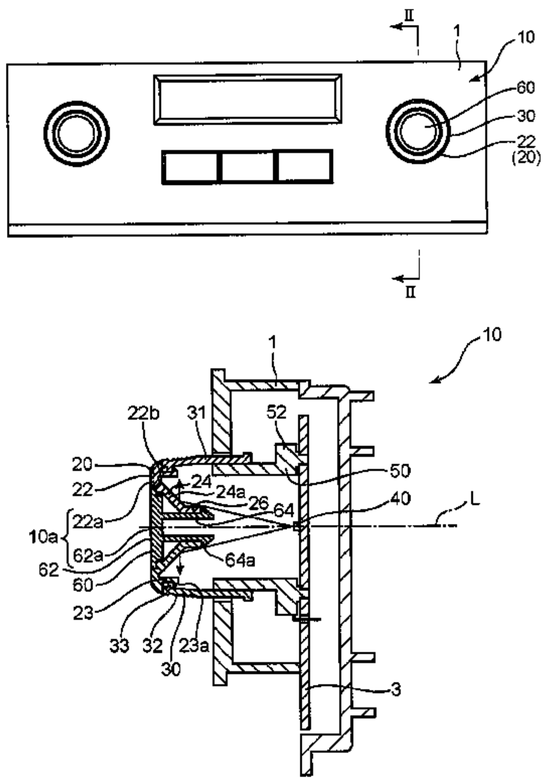


Fig. 1

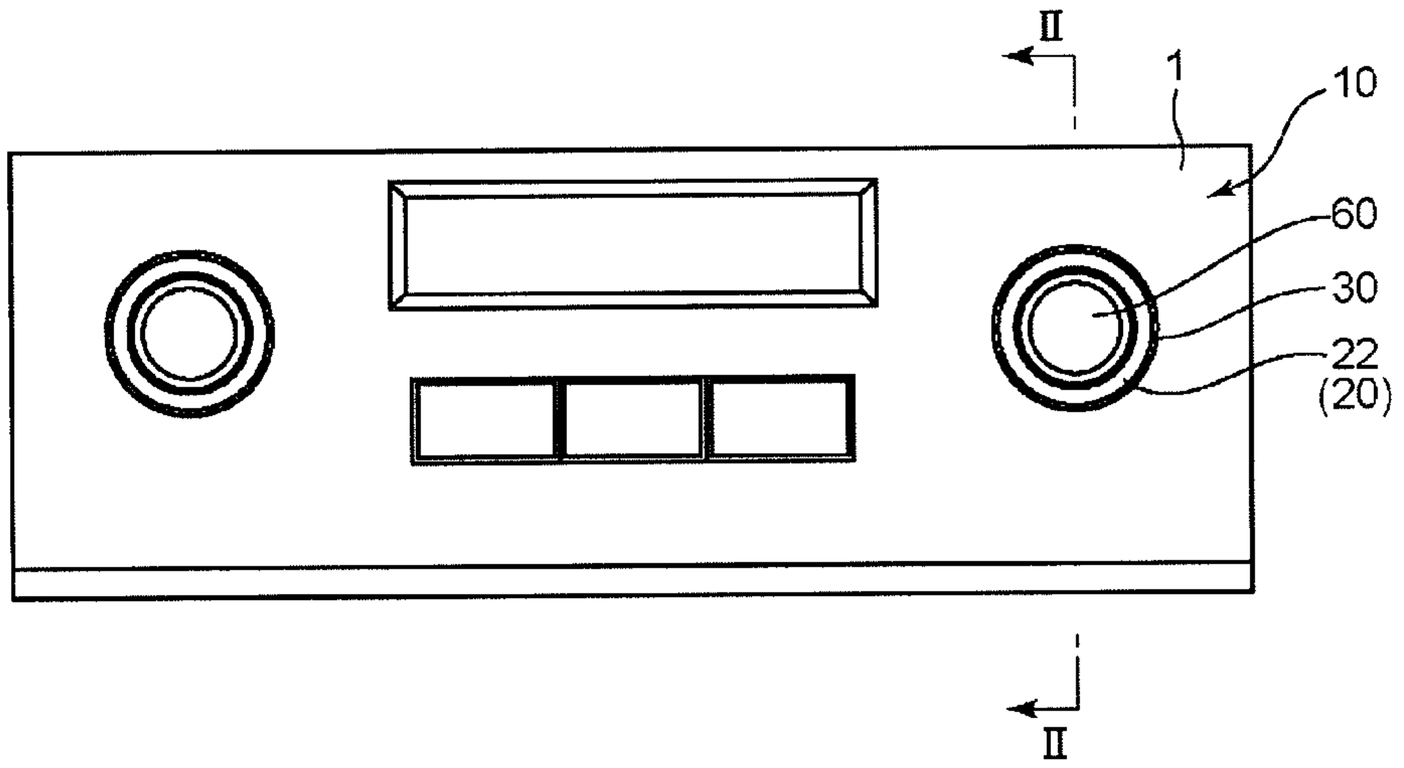

II
1
10
60
30
22
(20)
II

Fig. 2

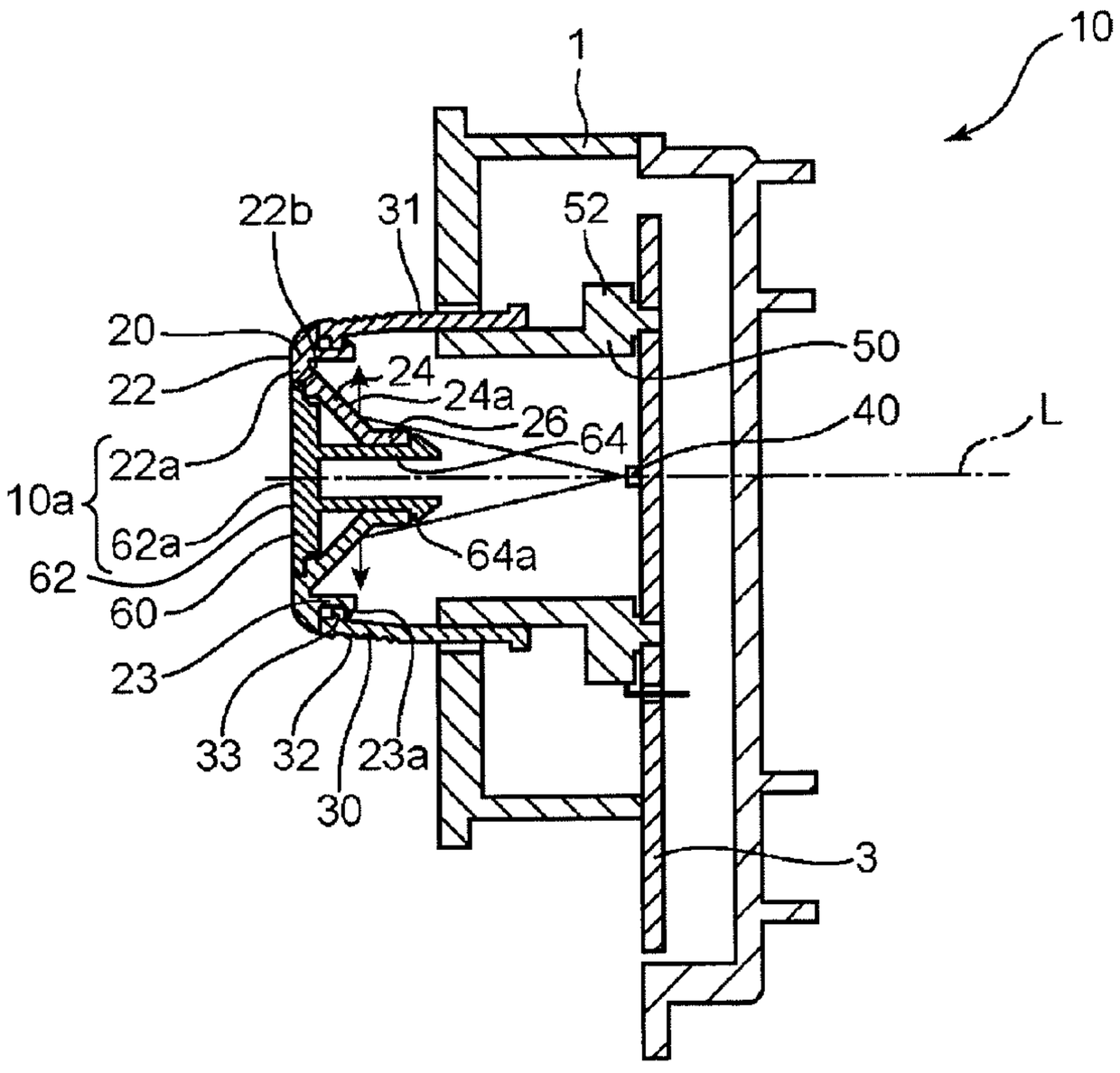

1
10
22b
31
52
20
22
24
24a
26
64
50
40
L
10a
22a
62a
62
64a
60
23
33
32
23a
30
3

Fig. 3

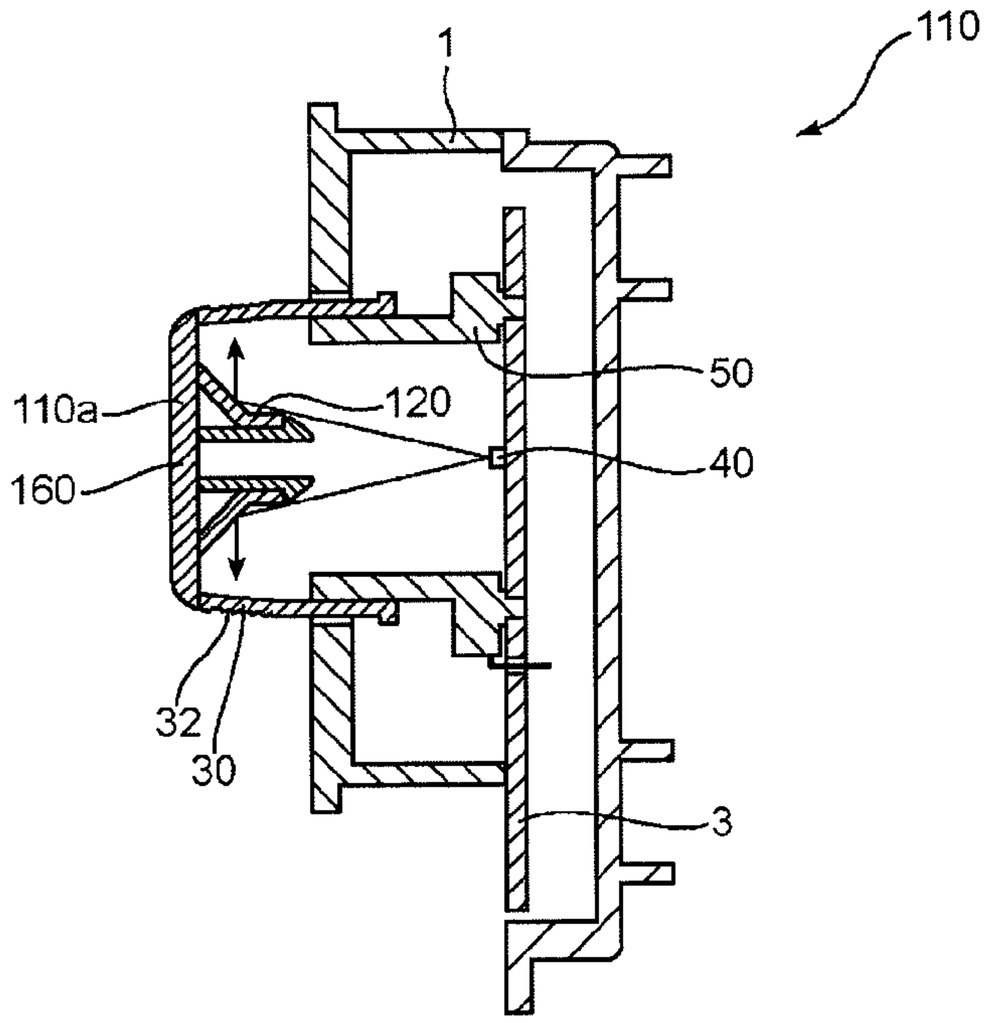

1
110
50
110a
120
40
160
32
30
3

Fig. 4

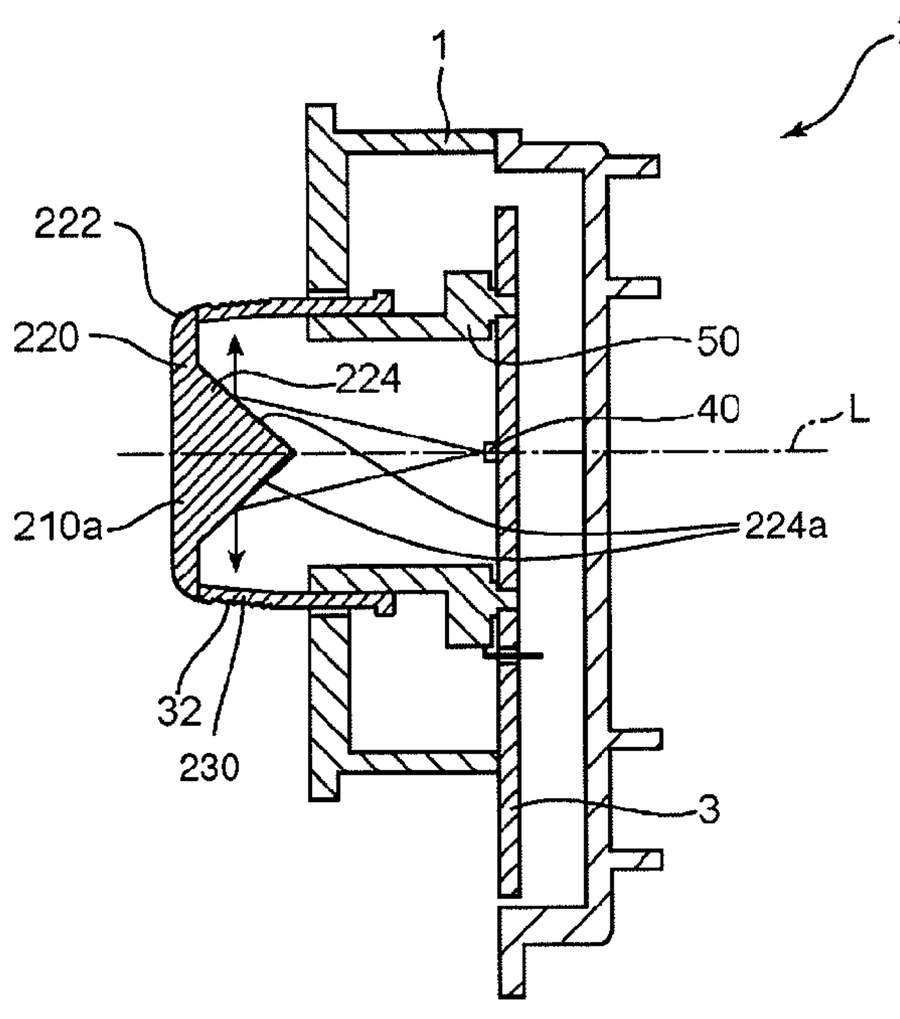

1
210
222
220
224
50
40
L
210a
224a
32
230
3

Fig. 5

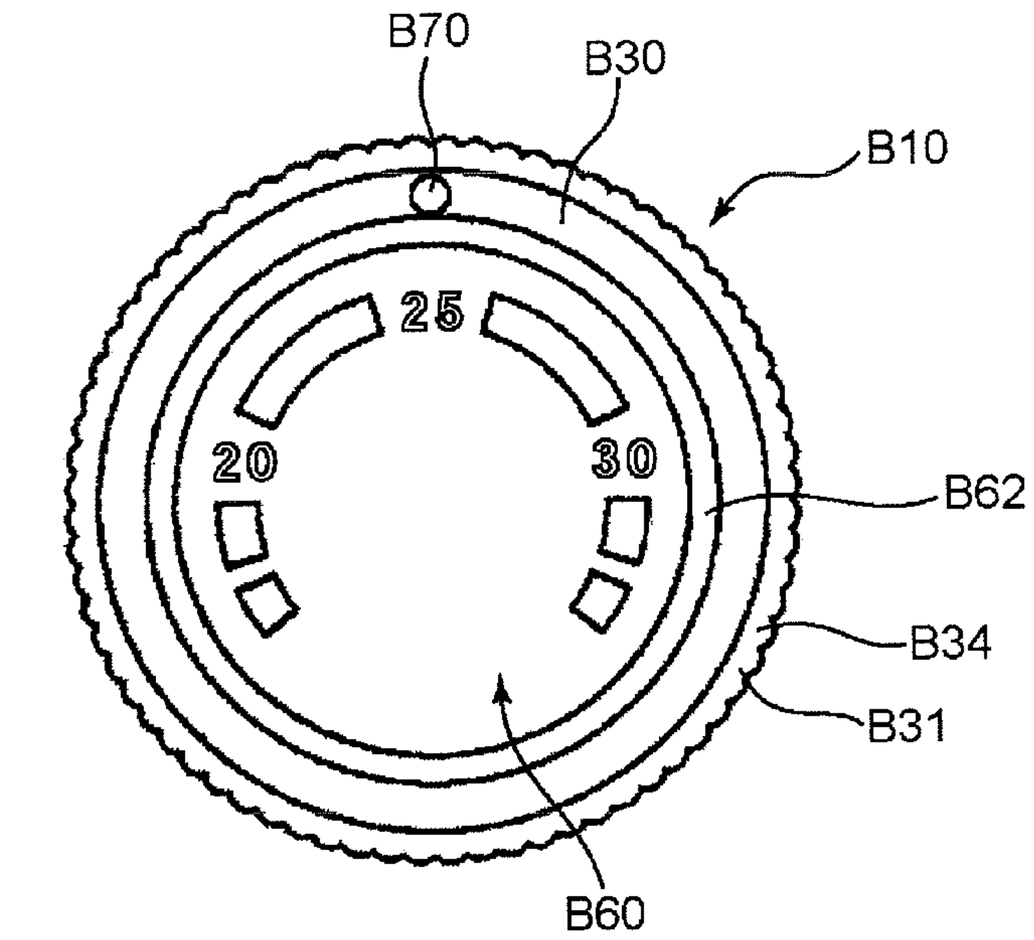
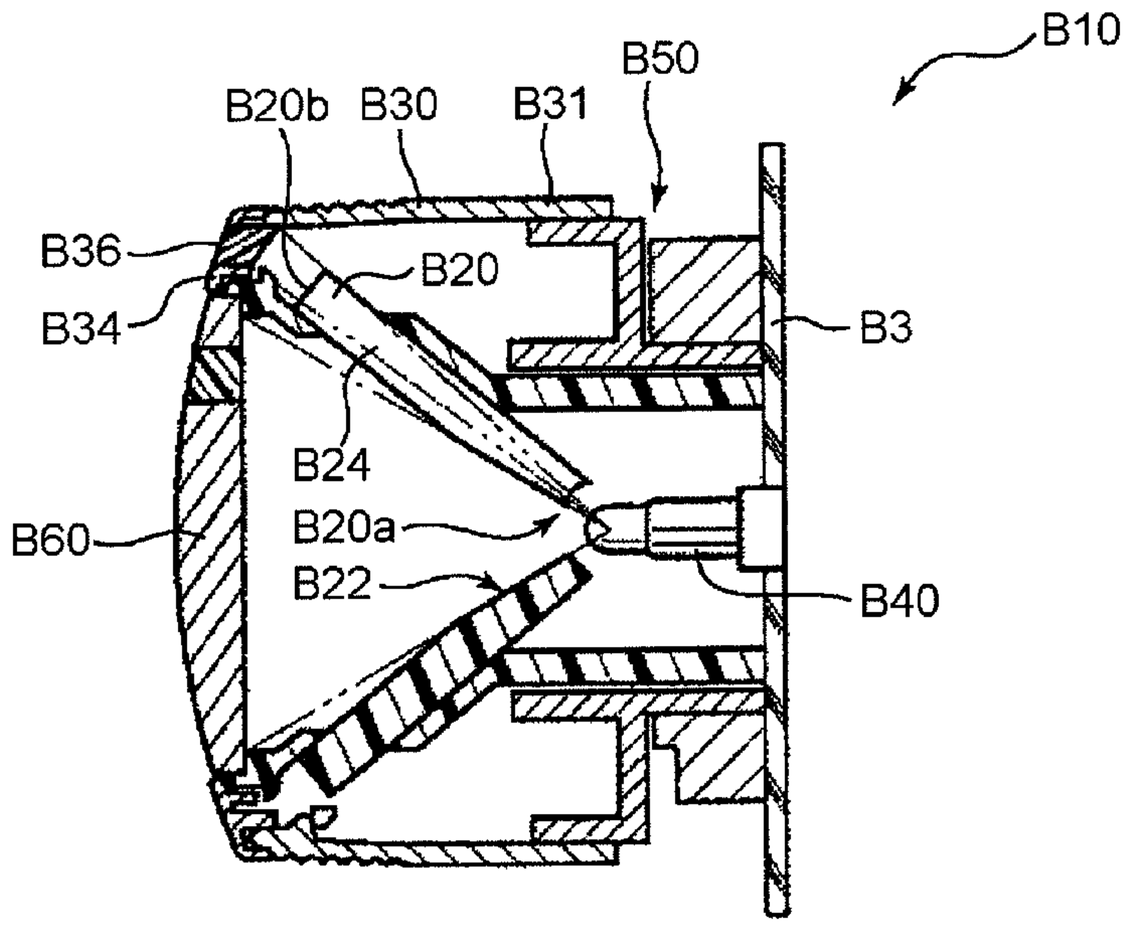

B70
B30
B10
25
20
30
B62
B34
B31
B60

Fig. 6


B10
B50
B20b
B30
B31
B36
B20
B34
B3
B24
B60
B20a
B22
B40

OPERATION DEVICE

TECHNICAL FIELD

The present invention relates to an operation device having an operation knob that is rotationally operated.

BACKGROUND ART

Conventionally, an operation device having a rotationally operated operation knob is provided to an instrumental panel and the like of an automobile. Rotating the operation knob changes a rotation amount of a rotary encoder and the like. According to the rotation amount, an operation object, such as air conditioner temperature and audio instrument volume, is controlled. In some cases, such an operation device is provided with an illumination light source in order to illuminate an operation knob or the like.

For example, Patent Literature 1 discloses an operation device B**10** that changes and controls air conditioner temperature, as shown in FIGS. **5** and **6**. The operation device B**10** includes a rotary encoder B**50**, a fixed display B**60** having a circular plate shape, an operation knob B**30**, an illumination light source B**40**, and a light guiding body B**20**. The operation knob B**30** has a cylindrical peripheral wall B**31**. The operation knob B**30** rotates around the fixed display B**60**. The operation knob B**30** has a front end surface B**34** extending substantially parallel to the fixed display B**60**. The illumination light source B**40** and the light guiding body B**20** are provided on a reverse side of the fixed display B**60**.

The fixed display B**60** is provided with a display marking B**62** indicating air conditioner temperature or the like. The front end surface B**34** of the operation knob B**30** is provided with a pointer display B**36** indicating a rotation position of the operation knob B**30**. The light guiding body B**20** guides light from the illumination light source B**40** to the fixed display B**60** and the front end surface B**34** of the operation knob B**30**. The light from the illumination light source B**40** illuminates the display marking B**62** and the pointer display B**36**.

Specifically, the light guiding body B**20** is provided inside the operation knob B**30**. The light guiding body B**20** has a reversed cone shape. A through hole B**20***a* is provided at a vertex of the light guiding body B**20**. The through hole B**20***a* and the illumination light source B**40** face each other. A bottom surface B**20***b* of the light guiding body B**20** and the pointer display B**36** face each other. An interior portion B**22** of a wall defining a reversed cone shape of the light guiding body B**20** acts as a central light guiding path. The light from the illumination light source B**40** passes through the through hole B**20***a* and enters the interior portion B**22** of the light guiding body B**20**. The interior portion B**22** of the light guiding body B**20** guides the light from the illumination light source B**40** toward a fixed display B**60** side. Further, a wall interior B**24** of the light guiding body B**20** acts as a side light guiding path. The wall interior B**24** of the light guiding body B**20** guides the light from the illumination light source B**40** to the front end surface B**34** of the operation knob B**30**.

In the operation device having the rotationally operated operation knob described above, it is desirable that the peripheral wall of the operation knob is illuminated along a circumferential direction in order to indicate a position of the operation knob or from a viewpoint of design.

As a configuration in which such illumination is performed in the operation device B**10** disclosed in the Patent Literature 1, for example, a configuration may be considered in which the bottom surface B**20***b* of the light guiding body B**20** faces the peripheral wall B**31** of the operation knob B**30**. In this

configuration, the wall interior B**24** of the light guiding body B**20** guides the illumination light source B**40** to the peripheral wall B**31** of the operation knob B**30**. In this configuration, however, the light needs to pass through the wall interior B**24** of the light guiding body B**20**. Therefore, the wall of the light guiding body B**20** of this configuration becomes thick and the thick-walled light guiding body B**20** is provided along the circumferential direction of the operation knob B**30**, which results in an increase in weight and cost.

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Patent No. 3744799

SUMMARY OF INVENTION

Accordingly, an object of the present invention is to provide an operation device capable of illuminating a peripheral wall of an operation knob along a circumferential direction in a simple configuration.

Solution to Problem

In order to achieve the object, an operation device of the present invention includes an operation knob having a substantially cylindrical peripheral wall centering on an axis extending in a front-rear direction and rotating around the axis in response to a rotational operation, the peripheral wall being provided with an illuminated portion in a circumferential direction; an illumination light source provided on a rear side of the illuminated portion on an axis line of the operation knob and emitting light frontward; and a reflector provided on a front side of the illumination light source and connected to the operation knob. A surface of the reflector includes a reflection surface provided on an inner side of the peripheral wall of the operation knob and capable of reflecting the light from the illumination light source. The reflection surface has a shape extending in the circumferential direction centering on the axis line of the operation knob and having a diameter increasing toward the front side such that the light emitted frontward from the illumination light source is reflected by the reflection surface toward the illuminated portion.

According to the device, with a simple configuration including the reflector that reflects the light from the illumination light source, the illuminated portion provided on the peripheral wall of the operation knob is illuminated in the circumferential direction. Further, it is not necessary for the device to have a thick wall for the reflector that guides the light from the illumination light source to the peripheral wall of the operation knob, thereby achieving a reduction in weight of the entire device and a reduction in cost.

BRIEF DESCRIPTION OF DRAWINGS

[FIG. **1**] A front view showing a state in which an operation device according to the present invention is attached to a panel.

[FIG. **2**] A cross-sectional view taken along a line II-II in FIG. **1**.

[FIG. **3**] A cross-sectional view of an operation device according to another embodiment of the present invention.

[FIG. **4**] A cross-sectional view of an operation device according to another embodiment of the present invention.

[FIG. **5**] A front view of a conventional operation device.

[FIG. **6**] A cross-sectional view of FIG. **5**.

DESCRIPTION OF EMBODIMENTS

Preferable embodiments of the present invention are described with reference to the drawings.

In the present embodiment, an operation device **10** according to the present invention is used as a means to control temperature of an air conditioner. The operation device **10** is attached to a panel **1** extending in a predetermined direction. The panel **1** configures a portion of an instrumental panel of a vehicle. FIG. **1** is a schematic front view showing a state in which the operation device **10** is attached to the panel **1**. FIG. **2** is a cross-sectional view taken along a line II-II in FIG. **1**.

The operation device **10** includes a reflector **20**, an operation knob **30**, an LED (illumination light source) **40**, a rotary encoder element **50**, and a cover **60**.

The rotary encoder element **50** includes a rotator **52** that rotates around a predetermined rotation axis and an outputter (not shown in the drawings). The outputter (not shown in the drawings) of the rotary encoder element **50** outputs a signal corresponding to a rotation angle of the rotator **52**. The rotator **52** is rotatably fixated to a circuit board **3**. The circuit board **3** is provided behind the panel **1**, that is, a reverse side of the panel **1**. The rotator **52**, which is approximately parallel to the panel **1**, has a substantially cylindrical shape. A central axis, that is, a rotation axis L of the rotator **52** extends in a front-rear direction, that is, in a direction orthogonal to the circuit board **3** and the panel **1**.

The LED **40** illuminates an illuminated portion **32** (described later) of the operation knob **30**. The LED **40** is mounted on the circuit board **3**. The LED **4** is mounted along the rotation axis L of the rotator **52**. The LED **40** emits light frontward, that is, toward a panel **1** side.

The operation knob **30** is rotationally operated by an occupant of a vehicle or the like. The operation knob **30** is configured with a peripheral wall **31** having a substantially cylindrical shape. The peripheral wall **31** extends in the front-rear direction centering on the rotation axis L of the rotator **52** of the rotary encoder element **50**. The operation knob **30** is provided on the front side of the LED **40**. The operation knob **30** is connected to the rotator **52**. A front end portion of the rotator **52** is inserted into an interior of a rear side portion of the operation knob **30**. The operation knob **30** is connected to the rotator **52** so as to be integrally rotatable. The operation knob **30** rotates around the rotation axis L. A front side portion of the operation knob **30** protrudes toward a front side of the panel **1**. Thereby, an occupant or the like can operate the operation knob **30**. When the operation knob **30** rotates around the rotation axis L in response to a rotational operation by the occupant or the like, the rotator **52** rotates accordingly. Then, a signal corresponding to the rotation angle of the rotator **52** is output from the outputter. Based on the output signal, the temperature of the air conditioner is changed.

The illuminated portion **32** which is illuminated by the LED **40** is provided to a portion of the peripheral wall **31** of the operation knob **30** protruding toward the front side of the panel **1**. The illuminated portion **32** is provided along the circumferential direction of the peripheral wall **31**. The illuminated portion **32** extends over an entire periphery of the peripheral wall **31**. The illuminated portion **32** has a predetermined width in a direction parallel to the rotation axis L. The illuminated portion **32** is configured with a translucent material. When the illuminated portion **32** is illuminated by the LED **40**, the illuminated portion **32** transmits light from the LED **40** to the exterior. Thereby, the operation knob **30** is illuminated in a ring shape.

For example, an entirety of the operation knob **30** is formed of a transparent material such as acrylic, polycarbonate, ABS, or the like. The operation knob **30** except the illuminated portion **32** is coated with a light-shielding coating material. Thereby, only the illuminated portion **32** transmits light in the operation knob **30**.

A lock **33** is provided to a front end of the operation knob **30**, the lock **33** protruding inward in a radial direction.

The reflector **20** guides the light from the LED **40** to the illuminated portion **32** and also serves as a decorating member of the operation device **10**. The reflector **20** includes a decorative portion **22**, a reflecting portion **24**, and a latching portion **26**. The decorative portion **22** extends in a direction orthogonal to the rotation axis L. The reflecting portion **24** extends rearward from a rear surface of the decorative portion **22**. The latching portion **26** extends rearward from a rear end of the reflecting portion **24**. The reflector **20** is connected to the operation knob **30**. An outer peripheral edge of the decorative portion **22** in the reflector **20** is in contact with a front end of the peripheral wall **31** of the operation knob **30**. The reflecting portion **24** and the latching portion **26** in the reflector **20** are housed inside of the peripheral wall **31** of the operation knob **30**.

The decorative portion **22**, the reflecting portion **24**, and the latching portion **26** are mutually integrally formed. An entire surface of the reflector **20**, which is integrally formed of the portions **22**, **24**, and **26**, is plated. A plating-material coating the surface of the reflector **20** has a light reflection property. It is preferable that the plating-material has an excellent decorative property, by further having glossy finish and the like. In the present embodiment, the entire surface of the reflector **20** is silver-plated.

The decorative portion **22** is in a ring shape centering on the rotation axis L. The decorative portion **22** extends inward from the peripheral wall **31** of the operation knob **30** in the radial direction. The decorative portion **22** is exposed to a front surface of the operation device **10**. A front surface **22***a* of the decorative portion **22**, along with a front panel **62***a* of a panel **62** of a cover **60** (described later), configures a front surface **10***a* of the operation device **10**. In this embodiment, as descried above, the entire surface of the reflector **20** is silver-plated. Accordingly, in the front surface **10***a* of the operation device **10**, a ring-shaped portion surrounding the rotation axis L and configured with the front surface **22***a* of the decorative portion **22** is decorated with silver-plating. The front surface **22***a* of the decorative portion **22** serves as a decorative surface decorating the operation device **10**.

A rearward protruding locked portion **23** is provided to a rear surface of the decorative portion **22**. A locking tab **23***a* is provided at a rear end of the locked portion **23**, the locking tab **23***a* protruding outward in a radial direction. The locking tab **23***a* has a shape that enables latching onto the lock **33** of the operation knob **30**. Due to latching between the locking tab **23***a* and the lock **33**, the decorative portion **22**, and hence the reflector **20**, is connected to the operation knob **30** so as to be integrally rotatable. Specifically, the locking tab **23***a* is in contact with a rear end portion of the lock **33** from the rear side. This contact prevents the reflector **20** from dropping off frontward. Further, a connection structure between the reflector **20** and the operation knob **30** is not limited to this. For example, the reflector **20** and the operation knob **30** may be mutually integrally formed by double molding or the like.

The reflecting portion **24** extends rearward from a rear surface of an inner peripheral edge **22***b* of the decorative portion **22**. The reflecting portion **24** is provided inside the peripheral wall **31** of the operation knob **30**. The reflecting portion **24** faces the illuminated portion **32**. An outer surface **24***a* of the reflecting portion **24** configures a reflection surface that reflects the light from the LED **40**. The shape of the outer

surface **24***a* is set such that the light emitted forward from the LED **40** is reflected by the outer surface **24***a* and the reflected light travels toward the illuminated portion **32**. Specifically, the reflecting portion **24** has a shape centering on the rotation axis L and having a diameter increasing toward the front side. In the present embodiment, the reflecting portion **24** has a circular truncated cone shape having a hollow therein. The outer surface **24***a* of the reflecting portion **24** configuring the reflection surface extends in a circumferential direction centering on the rotation axis L and has a diameter conically increasing toward the front side.

As described above, the light from the LED **40** is reflected by the outer surface **24***a* of the reflecting portion **24**. This reflected light travels to the illuminated portion **32** and illuminates the illuminated portion **32**. In this embodiment, the outer surface **24***a* of the reflecting portion **24** has a circular truncated cone shape and extends in the circumferential direction centering on the rotation axis L, on which the LED **40** is provided. Therefore, the light from the LED **40** is uniformly reflected in the circumferential direction by the outer surface **24***a* of the reflecting portion **24**. As a result, the illuminated portion **32** is uniformly illuminated in the circumferential direction by the light from the LED **40**. In addition, in the present embodiment, the entire surface of the reflector **20** is silver-plated as described above. Therefore, the light from the LED **40** is reflected to the illuminated portion **32** by the silver-plated surface with high reflectance.

The latching portion **26** has a cylindrical shape centering on the rotation axis L. The latching portion **26** extends rearward from the back end of the reflecting portion **24**. The latching portion **26** and a tab **64***a* (described later) of the cover **60** latch onto each other. Due to this latching, the cover **60** is fixated to the reflector **20**.

The cover **60** covers an opening on a front side of the operation knob **30**. The cover **60** has the panel **62** and a latched portion **64**, the panel **62** having a circular plate shape centering on the rotation axis L. The panel **62** extends parallel to the panel **1**. The latched portion **64** extends rearward from a rear surface of the panel **62**.

The panel **62** is mounted inside the decorative portion **22**. An outer peripheral edge of the panel is in contact with an inner peripheral edge of the decorative portion **22**. The panel **62** covers, from the front side, the reflecting portion **24** and the latching portion **26** of the reflector **20** provided on the rear side of the decorative portion **22**. A central portion of the opening on the front side of the operation knob **30** is covered by the panel **62**. An outer peripheral portion of the opening on the front side of the operation knob **30** is covered by the decorative portion **22**. Accordingly, the front surface **62***a* of the panel **62** and the front surface **22***a* of the decorative portion **22** configure the front surface **10***a* of the operation device **10**. The front surface **10***a* of the operation device **10** is exposed to the front surface of the operation device **10**.

The latched portion **64** has a substantially cylindrical shape centering on the rotation axis L. The latched portion **64** extends rearward from the rear surface of the panel **62**. The tab **64***a* is provided to a rear end portion of the latched portion **64**, the tab **64***a* protruding outward in the radial direction. The tab **64***a* and the latching portion **26** of the reflector **20** latch onto each other. Due to this latching, the latched portion **64** is fixated to the reflector **20**. Specifically, the tab **64***a* is in contact with the rear end portion of the latched portion **64** from the rear side. This contact prevents the latched portion **64**, as well as the cover **60**, from dropping off frontward.

In the operation device **10** configured as described above, the light emitted frontward from the LED **40** is reflected by the outer surface **24***a* of the reflecting portion **24** of the reflector **20**. The reflected light travels outward in the radial direction and illuminates the illuminated portion **32** of the peripheral wall **31** of the operation knob **30**. Thereby, an entire periphery of the peripheral wall **31** of the operation knob **30** is illuminated. In other words, an outer periphery of the operation device **10** is illuminated. In particular, in the operation device **10**, the outer surface **24***a* of the reflecting portion **24** that acts as a reflection surface expands in the circumferential direction centering on the rotation axis L of the operation knob **30**. The LED **40** is provided on the rotation axis L. Accordingly, the light from the LED **40** uniformly illuminates the illuminated portion **32**. In addition, the outer surface **24***a* of the operation device **10** is silver-plated. Thus, the illuminated portion **32** is illuminated with high illuminance. Further, the front surface **22***a* of the decorative portion **22** is exposed to the front side of the operation device **10** and configures a portion of the front surface **10***a* of the operation device **10**. Thus, the silver-plated front surface **22***a* of the decorative portion **22** decorates the front surface **10***a* of the operation device **10**, enhancing design of the operation device **10**. In this way, in the operation device **10**, the reflector **20** acts as a reflecting member reflecting the light of the LED **40** to the illuminated portion **32** and also as a decorating member decorating the operation device **10** by being exposed to the front side of the operation device **10**.

Herein, the reflector may not be exposed to the front side of the operation device, and accordingly, the function of the reflector as the decorating member may be omitted. For example, as shown in FIG. **3**, the decorative portion **22** of a reflector **120** may be omitted. Accordingly, a front surface **110***a* of an operation device **110** may be configured with a cover **160** only. However, when a portion of the reflector **120** is exposed to a front side of the operation device **110** to act as a decorating member of the operation device **110**, such a configuration has a simple structure compared with the configuration in which a decorating member is separately provided.

Further, the cover **60** may be omitted. For example, a reflector **220** may have a shape shown in FIG. **4**. In the reflector **220**, a decorative portion **222** has a circular plate shape. In addition, the reflector **220** covers an entire opening on a front side of an operation knob **230**. In this configuration, the decorative portion **222** of the reflector **220** can decorate an entire front surface **210***a* of an operation device **210**. Moreover, in this configuration, the latching portion **26** that latches onto the cover **60** can be omitted. Accordingly, a reflection surface **224***a* configuring a reflecting portion **224** has a cone shape having a vertex on the rotation axis L of the operation knob **30**. Therefore, the configuration of the reflector **220** is simplified.

Further, plating of the reflector **20** is not limited to silver-plating. In addition, the plating can be omitted. However, in a configuration in which the entire surface of the reflector **20** is plated, a light reflectance at a reflection surface is increased, and the illuminated portion **32** of the operation knob **30** is illuminated with higher illuminance. In addition, design of the decorative portion **22** is enhanced, which enhances design of the entire operation device **10**.

A specific shape of the decorative portion **22** of the reflector **20** is not limited to the above-described shape. For example, as described above, the decorative portion **22** may have a circular plate shape that covers the entire opening of the operation knob **30**. Further, the decorative portion **22** may have a shape that covers only a portion in the circumferential direction of the opening on the front side of the operation knob **30**.

A specific configuration of the illuminated portion **32** of the operation knob **30** is not limited to the above-described configuration, as long as the illuminated portion **32** is provided in the circumferential direction of the peripheral wall **31** of the operation knob **30**. In other words, the illuminated portion **32** may not be provided. For example, the illuminated portion **32** may have a shape that extends along the peripheral wall **31** and may be provided only in an area within a predetermined angle in the circumferential direction of the peripheral wall **31**. Further, the illuminated portion **32** may be intermittently provided in the circumferential direction of the peripheral wall **31**. In addition, a specific shape of the reflecting portion **24** of the reflector **20** is not limited to the above-described shape. For example, the reflecting portion **24** may have a shape that configures only a portion of a cone centering on the rotation axis L, corresponding to the illuminated portion **32** provided only in an area within a predetermined angle in the circumferential direction of the peripheral wall **31**. Moreover, a position of the reflecting portion **24** may be any position as long as the position allows the reflecting portion **24** to reflect the light from the LED **40** to the illuminated portion **32**. Accordingly, the reflecting portion **24** may be provided in a position that is displaced toward a LED **40** side from a position facing the illuminated portion **32**.

The operation knob **30** does not have to rotationally operate the rotary encoder element **50** as long as the operation knob **30** rotates in response to a rotational operation.

Application of the operation device **10** is not limited to a means that controls the temperature of the air conditioner.

As described above, the present invention provides an operation device including an operation knob having a substantially cylindrical peripheral wall centering on an axis extending in a front-rear direction and rotating around the axis in response to a rotational operation, the peripheral wall being provided with an illuminated portion in a circumferential direction; an illumination light source provided on a rear side of the illuminated portion on an axis line of the operation knob and emitting light frontward; and a reflector provided on a front side of the illumination light source and connected to the operation knob. A surface of the reflector includes a reflection surface provided on an inner side of the peripheral wall of the operation knob and capable of reflecting the light from the illumination light source. The reflection surface has a shape extending in the circumferential direction centering on the axis line of the operation knob and having a diameter increasing toward the front side such that the light emitted frontward from the illumination light source is reflected by the reflection surface toward the illuminated portion.

In this device, the reflection surface of the reflector reflects the light from the illumination light source. Then, the reflected light reaches and illuminates the illuminated portion provided on the peripheral wall of the operation knob. In this device, the illumination light source is provided on the axis line of the operation knob. In addition, the reflection surface extends in the circumferential direction centering on the axis line. Thus, the reflection surface uniformly reflects the light from the illumination light source around the axis line of the operation knob, in other words, in the circumferential direction of the peripheral wall of the operation knob. Thereby, the illuminated portion is more uniformly illuminated. Moreover, in this device, the surface of the reflector reflects the light from the illumination light source. Therefore, it is not necessary to increase the thickness of the reflector. In other words, compared with a device, such as in the Patent Literature 1, in which a light guiding body is employed to guide light from the illumination light source to the peripheral wall of the operation knob and the light passes through inside the wall of the light guiding body, the reflector of the present device is thinner, the reflector being a member guiding the light from the illumination light source to the peripheral wall of the operation knob. This results in lighter weight of the entire device and a reduction in cost.

In the present invention, the entire surface of the reflector is plated, and a portion of the plated surface of the reflector configures the reflection surface that reflects the light from the illumination light source. It is preferable that at least a portion of the plated surface of the reflector other than a portion configuring the reflection surface is exposed to a front surface of the operation device to configure a decorative surface.

In this configuration, the reflection surface is plated. Thereby, a reflectance on the reflection surface is improved, which results in improved illuminance at the illuminated portion. In addition, in this configuration, the decorative surface that is a portion of the plated surface of the reflector is exposed to the front surface of the operation device. Thus, this decorative surface decorates the front surface of the operation device by plating. Accordingly, the reflector acts as a reflecting member reflecting the light from the illumination light source as well as a decorating member decorating the operation device by plating. This simplifies the configuration of the device compared with a case in which these components are separately provided.

Examples of the illuminated portion includes a component having a shape extending in the circumferential direction of the peripheral wall of the operation knob.

Further, in the present invention, the illuminated portion has a shape extending over an entire periphery of the peripheral wall of the operation knob. The reflector includes a reflection portion provided on the inner side of the operation knob and extending over the entire periphery in the circumferential direction centering on the axis line of the operation knob; and a substantially ring-shaped decorative portion centering on the axis line of the operation knob and extending in a direction substantially orthogonal to the axis line, the decorative portion being provided at a front end of the reflection portion and being connected to a front end of the operation knob. A cover covering the reflection member is attached on an inner side of the decorative portion of the reflector. A portion of the surface of the reflection portion of the reflector configures the reflection surface while the substantially ring-shaped front surface of the decorative portion of the reflector configures the decorative surface.

In this configuration, the reflection surface included in the surface of the reflection portion of the reflector reflects the light from the illumination light source to the illuminated portion. Then, along with the cover, the decorative surface configured by the front surface of the decorative portion of the reflector configures the front surface of the operation device. Thus, while illumination over the entire periphery of the operation knob is provided, a substantially ring-shaped decoration is provided on the operation device.

A specific shape of the reflection portion of the reflector includes a cone centering on the axis line of the operation knob and having a diameter increasing toward the front side.

The invention claimed is:

1. An operation device, comprising:

an operation knob having a substantially cylindrical peripheral wall centering on an axis extending in a front-rear direction and rotating around the axis in response to a rotational operation, the peripheral wall being provided with an illuminated portion in a circumferential direction;

an illumination light source provided rearward of the illuminated portion on an axis line of the operation knob and emitting light frontward; and

a reflector provided forward of the illumination light source and connected to the operation knob, wherein

a surface of the reflector includes a reflection surface provided inward of the peripheral wall of the operation knob and configured to reflect the light from the illumination light source; and

the reflection surface has a shape extending in the circumferential direction centering on the axis line of the operation knob and having a diameter increasing toward a front side such that the light emitted frontward from the illumination light source is reflected by the reflection surface toward the illuminated portion.

2. The operation device according to claim **1**, wherein

an entire surface of the reflector is plated;

a portion of the plated surface of the reflector configures the reflection surface that reflects the light from the illumination light source; and

at least a portion of the plated surface of the reflector, other than a portion configuring the reflection surface, configures a decorative surface exposed to a front surface of the operation device.

3. The operation device according to claim **2**, wherein

the illuminated portion has a shape extending in the circumferential direction of the peripheral wall of the operation knob.

4. The operation device according to claim **3**, wherein

the illuminated portion has a shape extending over an entire periphery of the peripheral wall of the operation knob;

the reflector includes a reflection portion provided inward of the operation knob and extending over the entire periphery in the circumferential direction centering on the axis line of the operation knob, and a substantially ring-shaped decorative portion centering on the axis line of the operation knob and extending in a direction substantially orthogonal to the axis line, the decorative portion being provided at a front end of the reflection portion and being connected to a front end of the operation knob;

a cover covering the reflection member is attached on an inner side of the decorative portion of the reflector; and

a portion of the surface of the reflection portion of the reflector configures the reflection surface while the substantially ring-shaped front surface of the decorative portion of the reflector configures the decorative surface.

5. The operation portion according to claim **4**, wherein

the reflection portion of the reflector has a cone shape centering on the axis line of the operation knob and having a diameter increasing toward the front side.

* * * * *